[Second Edition.]

PATENT SPECIFICATION

Application Date : April 6, 1927. No. 9445/27. **293,343**

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PROVISIONAL SPECIFICATION.

Method and Means for Determining Optimum Current Strength in the Electro Deposition of Rubber and other Substances.

We, DUNLOP RUBBER COMPANY LIMITED, a British company, of 32, Osnaburgh Street, London, N.W. 1, and FREDERICK HENRY LANE, a British subject, of the aforesaid company's works at Fort Dunlop, Erdington, Birmingham, in the County of Warwick, do hereby declare the nature of this invention to be as follows:—

This invention relates to a method and means for determining optimum current strength in the electro-deposition of substances such as the latex of rubber or other natural or artificial dispersion, emulsion or solution of natural vegetable resins, synthetic resins and the like or of compounds thereof.

In the process of depositing such substances electrophoretically, the strength of the current utilised affects certain characteristics of the product. For instance, if the current is too weak there results an irregular deposit having a rough surface while if the said current is too strong there is produced a porous deposit whereof the surface is striated. And between these two extremes lies a strength of current which will produce a perfectly smooth non-porous deposit.

Hitherto it has been the practice—in determining the current required to produce the desired characteristic—to make repeated deposits with different current strengths until the one most suitable is found.

It will be apparent that such a process is, in many ways, wasteful and it is an object of this invention to provide a method and means whereby the optimum current strength required to produce the desired characteristics may be determined with more expedition and efficiency.

According to this invention therefore, we produce a deposit having various characteristics; the same preferably varying between extremes of the characteristics hereinbefore referred to and provision being made whereby the current utilised in the production of the said several areas may be determined.

A suitable instrument for carrying our invention into effect comprises an anode in the form of a rectangular plate and, adjacent one end thereof a cathode in the form of a bar extending thereacross. The said electrodes are arranged at a suitable distance apart and insulated one from the other.

It will be apparent that the current strength utilised at the end of the anode adjacent the cathode will be greater than that utilised at the end of the anode remote from the said cathode the difference being occasioned by the difference in the length of the current path in the electrolyte.

Thus we are enabled to produce a single deposit varying between, relatively, thick and porous at one end—adjacent the cathode—and thin and irregular at the other end; between the two occurring an area of medium thickness and perfectly smooth and non-porous.

The said variance being occasioned by difference in the strength of the current utilised it will, then, be apparent that the said characteristics are in themselves a measure of the said current strength; and this is preferably indicated on a fixed scale arranged flanking the said deposit on the anode.

As the thickness of the deposit varies definitely with the current strength utilised the graduations of the said scale may be readily arrived at. The current strength required to produce any given thickness may be calculated; preferably the strength required to produce one given thickness being previously established empirically. Therefore, by gauging the thickness of a deposit produced under similar conditions upon the anode plate of the instrument according to this invention, the current strength corresponding to various points along its length may also be calculated. Thus the scale referred to may be graduated in terms of current strength.

In subsequent use the desired characteristic, say of appearance or constitution, is observed in the deposit and the optimum current strength required to produce that characteristic is indicated on the adjacent scale.

In conclusion it is not to be construed that we limit ourselves to the particular

instrument described for carrying our invention into effect as it will be apparent that a variety of means may be evolved to achieve the end required according to our said invention.

Dated this 5th day of April 1927.
H. K. TURNER,
Solicitor for the Applicants.

COMPLETE SPECIFICATION.

Method and Means for Determining Optimum Current Strength in the Electro Deposition of Rubber and other Substances.

We, DUNLOP RUBBER COMPANY LIMITED, a British company, of 32, Osnaburgh Street, London, N.W. 1, and FREDERICK HENRY LANE, a British subject, of the aforesaid company's works at Fort Dunlop, Erdington, Birmingham, in the County of Warwick, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a method and means for determining optimum current strength in the electro-deposition of substances from unvulcanised or vulcanised natural or artificial rubber emulsions with or without additional substances and also to natural or artificial vulcanised or unvulcanised emulsions of other rubber-like substances as for example gutta percha or balata with or without additional substances. The aqueous dispersion may also comprise one or more latices such as of rubber, gutta percha, balata or similar vegetable resins or artificial dispersions of rubber or similar artificial products such as synthetic resins or of wastes, reclaim, rubber substitutes or the like or mixtures of any of said dispersions. The dispersions may be in vulcanised or unvulcanised condition and may contain any one or more of the usual compounding ingredients.

In the process of depositing such substances electrophoretically the strength of the current utilised affects certain characteristics of the products, for instance, if the current is too weak there results an irregular deposit having a rough surface, while if the current is too strong there is produced a porous deposit whereby the surface is striated, and between these two extremes lies a strength of current which will produce a perfectly smooth, non-porous deposit.

Hitherto it has been the practice in determining the current required to produce the desired characteristic to make repeated deposits with different current strength until the one most suitable is found. It will be apparent that such a process is in many ways wasteful and it is an object of this invention to provide a method and means whereby the optimum current strength required to produce the desired characteristics may be determined with more expedition and efficiency.

According to this invention, therefore, we produce a deposit proportionately varying in its characteristics from one end to the other end, i.e. the deposit varying preferably between extremes of the characteristics hereinbefore referred to and provision being made whereby the current utilised in the production of the said several areas may be determined.

A suitable instrument for carrying our invention into effect comprises an anode in the form of a rectangular plate preferably made from a metal such as zinc and adjacent one end thereof a cathode in the form of a bar extending thereacross. The said electrodes are arranged at a suitable distance apart and insulated one from the other. It will be apparent that the current strength utilised at the end of the anode adjacent the cathode will be greater than that utilised at the end of the anode remote from the said cathode, the difference being occasioned by the difference in the length of the current path in the electrode. Thus, we are enabled to produce a single deposit varying between relatively thick and porous at one end—adjacent the cathode—and thin and irregular at the other end; between the two there being an area of medium thickness and perfectly smooth and non-porous, the said variance being occasioned by the difference in the strength of the current utilised. It will thus be apparent that the said characteristics can be made in themselves to form a measure of the current strength along the anode plate and say, determining the current strength, giving the type of deposit desired, this current determination being preferably indicated on a fixed scale arranged flanking the said deposit on the anode and which scale is to be calibrated by the method hereinafter to be described. As the thickness of a deposit varies for a definite emulsion, solution or dispersion definitely with the current strength utilised for a definite time interval the graduations of the said scale

may be readily arrived at. By way of example the following method may be adopted to arrive at the current strength required to produce any given thickness of deposit:—

A metal anode in the form of a cylinder is immersed in a tank containing say, latex and fillers which cylinder is surrounded by another cylinder serving as the cathode. An ammeter is introduced into the circuit and a current is then passed for one minute at a strength of one ampere per square decimeter. The deposit is then dried and the thickness is noted, which thickness let us call a. This thickness a is equivalent to a current density of one ampere per square decimeter. The current density indicator is then immersed in the same mixture and a deposit made for one minute on the anode plate, employing a suitable measured current amperage. The deposit formed on this anode plate is dried in a similar manner to which the deposit on the anode cylinder was subjected. The deposit on this anode plate is now gauged at different points along its length. At the point of thickness a the current density can be taken to be one ampere per square decimeter. At the point of thickness $\frac{a}{2}$ the current density must be 0.5 ampere per square decimeter. At a point where the thickness is $2a$ the current density can be taken to be two amperes per square decimeter. In this way the current strength corresponding to various points along its length may be calculated, and thus the scale may be graduated in terms of current strength. In subsequent use the desired characteristic say, of appearance or constitution for any given mix for which the instrument has been calibrated is observed in the deposit and the current strength required to produce that characteristic is indicated on the adjacent scale.

As one modification of the method herein described for the calibrating of the current density indicator it is pointed out that the current density indicator may be connected in series with concentric electrodes of suitable dimensions and a current passed of a strength of one ampere per square decimeter for the cylindrical anode for one minute, both the deposits on the respective anodes being dried and compared in the way above described.

Where the solutions, dispersions or emulsions worked with are sufficiently close in their chemical and physical properties it may be assumed that the instrument calibrated for one particular mix will give sufficiently accurate results for any mix.

In using this calibrated instrument in order to determine the current density per unit time in order to obtain a desired deposit it is necessary to connect the instrument in series with an ammeter and to pass for a definite time either a current of a strength found suitable in the calibration, or a multiple or submultiple of such a current is passed so that one area of the anodic deposit obtained will have the desired characteristics. In the case where a multiple or submultiple of the current used in calibration is passed the graduations of the current density indicator scale have to be multiplied by the factor easily determined so as to obtain the correct current densities along the scale and in particular the current density giving the desired deposit.

In order that the invention may be clearly understood and readily carried into effect the same is now described with reference to the accompanying drawings, although it will be appreciated that these drawings are given for illustrative purposes and not by way of limitation.

Fig. 1 is a plan of a current density indicator.

Fig. 2 is a side elevation of a current density indicator.

Fig. 3 is an end elevation.

Referring now to Fig. 1 D, C and E are the three ebonite sides of the current density indicator box, A being the zinc anode plate which is screwed on at the points F and G to the sides D and E.

Referring now to Fig. 2 B is the cathode bar, H is the scale calibrated so as to allow readings to be obtained in amperes per square decimeter. I is the deposit of rubber or the like. J and K are the electrode terminals.

With reference now to Fig. 3 A is the anode and B is the cathode.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. For use in the manufacture of rubber and the like articles by electrophoresis, a method for determining the most suitable current strength which consists in producing a varying deposit upon a suitable anode, means being provided to measure the strength of the current falling upon that part of the anode wherein the desired deposit is formed.

2. A method as claimed in Claim 1 wherein the anode is in plate form and means are provided for calibrating the anode, substantially as described.

3. A method according to either of the preceding claims wherein the current strength required to produce one given

thickness of the deposit on the anode may if desired be previously or simultaneously established experimentally and then by gauging the thickness of a deposit produced under similar conditions upon the anode plate of the instrument the current strength corresponding to the various points along its length may be calculated and thus allowing the fixed scale on the anode to be preferably graduated in terms of current strength.

4. A method according to Claim 3 wherein strips of the deposit parallel to the cathode bar are observed for the desired appearance or constitution and the optimum current strength required to produce the desired characteristic is then noted on the adjacent scale.

5. A method for determining the optimum current strength necessary to produce india rubber or the like deposits of desired characteristics by electro-deposition from aqueous dispersions of rubber or rubber-like substances with or without compounding ingredients substantially as described and for the purpose set forth.

6. Apparatus for carrying out the method as claimed in any of the preceding claims comprising an instrument which consists of an anode in the form of a rectangular metal plate and adjacent one end thereof a cathode in the form of a bar extending thereacross, the said electrodes being arranged at a suitable distance apart and insulated one from the other and the anode being provided with a fixed scale flanking the deposit thereon.

7. Apparatus for determining the optimum current strength required for electrophoresis operation substantially as herein described and with reference to the accompanying drawings.

Dated the 24th day of January, 1928.

H. K. TURNER,
Solicitor for the Applicants.

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2nd Edition

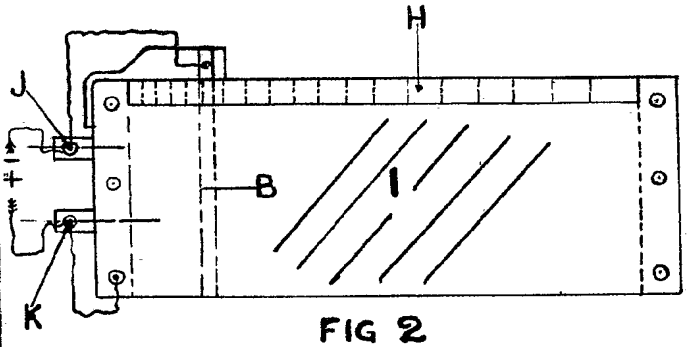

FIG 2

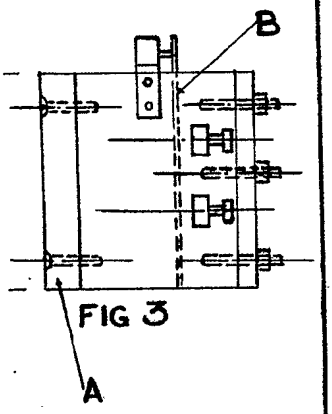

FIG 3

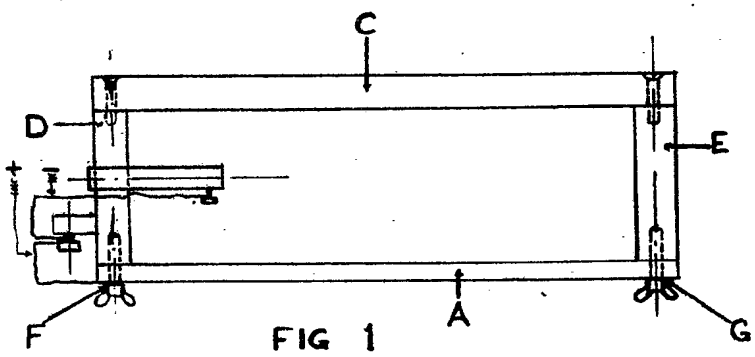

FIG 1

Charles & Read Ltd. Photo Litho.